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REMARKS

Claims 1, 4-5, 8 and 31-32 and 34-56 are all the claims presently pending in the present Application.

Claims 1, 4-5, 8, 31, 32 and 34-55 stand rejected under 35 U.S.C. §102 (e) as being anticipated by Yau et al. (US Patent No. 6,054,379) further in view of Allada et al. (6,218,317 B1) alone or in combination with Chen et al. (Effects of slurry formulations on chemical-mechanical polishing of low dielectric constant polysiloxanes: hydrido-organo siloxane and methyl silsesquioxane) and further in view of the Alleged Admitted Prior Art (AAPA).

Claim 56 stands rejected under 35 U.S.C. §103 (a) as being unpatentable over Yau, Allada, Chen, the AAPA, and further in view of Lu et al. (US Patent No. 6,008,540).

These rejections are respectfully traversed in view of the following discussion.

I. THE CLAIMED INVENTION

The claimed invention (e.g., as recited, for example, in claim 1 and similarly recited in claims 5, 41-42 and 49) is directed to a semiconductor device having a multi-layered insulation film formed on a semiconductor substrate. The multi-layered insulation film includes a first insulation layer including an organosiloxane film having a dielectric constant which is lower than a silicon oxide dielectric constant, a second insulation layer including a polysiloxane compound having an Si-H group and formed on and adhering to a top of the organosiloxane film of the first insulation layer, and a third insulation layer including an inorganic material and formed on and adhering to a top of the second insulation layer. The device further includes a plurality of wires which are formed in grooves formed in the multi-layered insulation film, the multi-layered insulation film filling a space between the wires (Application at Figure 1; page 23, lines 10-15).

Importantly, the methylated hydrogen silsesquioxane (MHSQ) layer adheres to the organosiloxane film and the inorganic material (Application at page 16, lines 8-21; Figure 3(b)).

Conventionally insulating layers may include an inorganic insulating layer (e.g., a silicon oxide layer) on an organic insulating layer. However, in devices formed by such conventional methods, during a subsequent planarizing step, peeling occurs at the interface between the

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organic and inorganic insulating layers, which can result in cross-talk between wires (e.g., wires which are separated by the insulating layers) in the semiconductor device (Application at Figure 5; page 2, lines 12-27; page 6, line 13 - Page 7, line 8).

The claimed invention, on the other hand, includes a second insulation layer which includes a methylated hydrogen silsesquioxane (MHSQ) layer which adheres to the organosiloxane film and the inorganic material (Application at page 16, lines 8-21; Figure 3(b)). The improved adhesion may help to allow a surface of the third insulation layer to be planarized together with a surface of a wire formed in one of the grooves without causing a peeling of the third insulation layer (Application at page 23, lines 6-9; Figure 3(b)).

#### **IV. THE EXAMINER HAS FAILED TO RESPOND TO APPLICANT'S TRAVERSAL ARGUMENTS**

Applicant would point out that the Examiner is required to answer all of the material traversed by Applicant. Indeed, Applicant would point out that MPEP §707.07(f) provides that "where the applicant traverses any rejection, the examiner should, if he or she repeats the rejection, take note of the applicant's argument and answer the substance of it" (emphasis added).

Here, the Examiner has clearly failed to answer all of the material traversed by Applicant. For example, in the Amendment filed on March 28, 2006, Applicant clearly asserted:

- 1) That neither the alleged references nor any alleged combination thereof teaches or suggests "*wherein said second insulation layer comprises a methylated hydrogen silsesquioxane (MHSQ) layer which adheres to said organosiloxane film and said inorganic material*", as recited in claim 1 and similarly recited in claims 5, 41, 42 and 49.
  
- 2) That Allada merely teaches that the methylated hardmask 18 is formed on the polymeric interlayer layer 16. Nowhere does Allada teach or suggest that the methylated hardmask 18 adheres to an organosiloxane film and an inorganic material.

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- 3) That layers 714, 716 and 718 in Yau are formed between the layer 710 (e.g., parylene, FSG, or SiO) and layer 722 (low k dielectric layer).

**Nowhere does Yau teach or suggest that either of layers 710 or 722 includes an organosiloxane film.** Therefore, even if the layers 714, 716, 718 in Yau would have been replaced with the methylated hardmask 18 in Allada, the alleged combination still would not teach or suggest a methylated hydrogen silsesquioxane (MHSQ) layer which adheres to an organosiloxane film and an inorganic material.

Nowhere has the Examiner even attempted to reply to these arguments of Applicant. Indeed, in the Office Action entitled "Response to Arguments", the Examiner simply responds by alleging that Applicant's asserted advantages of this feature "are ambiguous". Thus, the Examiner completely ignored the substance of Applicant's arguments.

Therefore, the Office Action is clearly incomplete that the Examiner must mail to Applicant a new non-final Office Action which responds to all of Applicant's arguments.

#### IV. ALLEGED PRIOR ART REFERENCES

##### A. Yau, Allada, Chen and the AAPA

The Examiner alleges that Yau would have been combined with Allada and Chen to form the invention of claims 1, 4-5, 8, 31, 32 and 34-55. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

##### 1. The Alleged References Would not have been Combined as Alleged by the Examiner

In contrast to Yau which is directed to a method of depositing an oxidized organo silane film, Allada is intended to address the problems involved with forming an undoped silicon glass (USG) hardmask on a polymer-insulated material without taking out a wafer from a spin-truck device, by producing multilayered wires in which both the hardmask and a layered insulation

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material are capable of being spin-coated. Further, in complete contrast to Yau and Allada, Chen is intended to provide a method for chemically and mechanically controlling the chemical mechanical polishing (CMP) characteristics of polysiloxanes which have low dielectric constants, and the AAPA simply teaches forming a silicon oxide film on a methyl silsesquioxane (MSQ) film 2 (Application at page 1, lines 16-21).

Thus, clearly Yau Allada, Chen and the AAPA have different problems and objects to be solved, and there clearly is no motivation to combine Yau, Allada, Chen and the AAPA as alleged by the Examiner. In short, Applicant respectfully submits that these references are unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

In fact, Applicant submits that the references provide no motivation or suggestion to urge the combination as alleged by the Examiner. Indeed, these references clearly do not teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

**2. Even if Combined, the Alleged Combination would not teach or suggest all of the Features of the Claimed invention**

Applicant again submits that neither Yau, nor Allada, nor Chen, nor the AAPA, nor any alleged combination thereof teaches or suggests "*wherein said second insulation layer comprises a methylated hydrogen silsesquioxane (MHSQ) layer which adheres to said organosiloxane film and said inorganic material*", as recited in claim 1 and similarly recited in claims 5, 41, 42 and 49. As noted above, the improved adhesion may help to allow a surface of the third insulation layer to be planarized together with a surface of a wire formed in one of the grooves without causing a peeling of the third insulation layer (Application at page 23, lines 6-9; Figure 3(b)).

Clearly, these features are not taught or suggested by the cited references. Indeed, the Examiner attempts to equate layer 710 (e.g., perylene) in Yau with the first insulation layer of the claimed invention, layer 722 (e.g., which is a polymeric layer and not an inorganic layer as the

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Examiner surprisingly suggests) in Yau with the third insulation layer of the claimed invention, and three layers 714 (e.g., oxidized organo silane), 716 (e.g., SiN), 718 (e.g., oxidized organo silane), with the second insulation layer of the claimed invention (Yau at Figure 10H).

The Examiner expressly concedes on page 3 of the Office Action that Yau does not teach or suggest a second insulation layer which includes an MHSQ layer but alleges that Allada teaches this feature. Specifically, the Examiner alleges that Yau would have been modified to replace the three layers 714, 716, 718 with the methylated hardmask 18 in Allada "since this (sic) dielectric layers exhibit low dielectric constants and also have better adhesion properties than conventional dielectric layers" (Office Action a page 4).

However, Applicant would point out that Yau merely mentions parylene, FSG, or silicon oxide as a first insulation layer 710 (e.g., see Yau at col. 13, line 13). Parylene is an organic layer (which does not contain Si), and FSG is a silicon oxidized layer which contains fluorine. Therefore, layer 710 in Yau (which the Examiner alleges corresponds to the first insulation layer of the claimed invention) is clearly different from the first insulation layer of the claimed invention which includes an organosiloxane (e.g., a silicone-line compound which contains organics).

Indeed, in the claimed invention, in order to improve the adhesion of both the first insulation layer including an organosiloxane and a third insulation layer including an inorganic material, an MHSQ layer may be formed between the first and third insulation layers as a second insulation layer. This constitution of the claimed invention does not exist in any one of the references cited in the Office Action.

Moreover, even if the three layers 714, 716, 718 in Yau would have been replaced with the methylated hardmask 18 in Allada, the methylated hardmask would be between layer 710 (e.g., perylene) and layer 722 (e.g., a polymeric layer) in Yau. That is, the methylated hardmask 18 would not even adhere to an organosiloxane film, let alone to an organosiloxane film AND an inorganic material.

The Examiner then alleges that Yau would have been further modified to replace layer 710 in Yau with the MSQ layer from the AAPA (Office Action at page 5). However, even assuming (arguendo) that Yau would have been so modified, the methylated hardmask layer 18

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would still not adhere to "an inorganic material" as in the claimed invention. Indeed, as noted above, the layer 722 in Yau is a polymeric layer and not an inorganic layer as the Examiner surprisingly suggests. Indeed, Yau teaches that layer 622 in Figure 9 is a polymer.

**Indeed, nowhere does the prior art teach or suggest using an MHSQ layer to improve adhesion been an organosiloxane film and an inorganic material, which is an important aspect of the claimed invention.** Indeed, Applicant would again point out that Yau teaches that oxidized organo silane films "provide excellent adhesion between different dielectric layers" (Yau at Abstract) and, therefore, the prior art teaches that there would be no reason to form an MHSQ layer on an organosiloxane film as the Examiner suggests.

In short, neither Allada, nor Chen, nor the AAPA, teaches or suggests a multilayer insulation film that includes a second insulation layer which includes a methylated hydrogen silsesquioxane (MHSQ) layer which adheres to an organosiloxane film and an inorganic material. Therefore, neither Allada, nor Chen, nor the AAPA make up for the deficiencies in Yau.

Therefore, Applicant respectfully submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

#### B. Lu

The Examiner alleges that Lu would have been combined with Yau, Allada, Chen and the Alleged Admitted Prior Art (AAPA) to form the invention of claim 56. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every feature of the claimed invention.

Lu discloses an integrated circuit which includes a xerogel layer 342, adhesion layer 344 and oxide layer 346 (Lu at Figure 3f).

However, Lu is unrelated to the other references. Indeed, the entire point of Lu is to surface treat a xerogel layer (e.g., porous silica) to improve its adhesion with other layers (Lu at Abstract). Thus, no person of ordinary skill in the art would have considered combining these

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disparate references, absent impermissible hindsight.

Further, Applicant submits that there is no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, these references clearly do not teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Further, neither Yau, nor Allada, nor Chen, nor the AAPA, nor Lu, nor any alleged combination thereof teaches or "*wherein said second insulation layer comprises a methylated hydrogen silsesquioxane (MHSQ) layer which adheres to said organosiloxane film and said inorganic material*", as recited in claim 1 and similarly recited in claims 5, 41, 42 and 49.

Clearly, this feature is not taught or suggested by the Lu. Indeed, Lu teaches an adhesion layer 144, 344 which includes hydrogen silsesquioxane which is different than MHSQ. Moreover, the layer 144, 344 is formed between a xerogel layer (porous silica) and oxide layer. Therefore, even assuming (arguendo) that layer 144, 344 included MHSQ, nowhere does Lu teach or suggest that layer 144, 244 **adheres to an organosiloxane film and an inorganic material.**

Indeed, nowhere does Lu or the other alleged prior art teach or suggest using an MHSQ layer to improve adhesion been an organosiloxane film and an inorganic material, which is an important aspect of the claimed invention. Indeed, Applicant would again point out that Yau teaches that oxidized organo silane films "provide excellent adhesion between different dielectric layers" (Yau at Abstract) and, therefore, the prior art teaches that there would be no reason to form an MHSQ layer on an organosiloxane film as the Examiner suggests.

Therefore, Lu clearly does not make up for the deficiencies of Yau, Allada, Chen and the AAPA.

Therefore, Applicant respectfully submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

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**V. FORMAL MATTERS AND CONCLUSION**

In view of the foregoing, Applicant submits that claims 1, 4-5, 8 and 31-32 and 34-56, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully submitted,

Date: 11/14/06

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**CERTIFICATE OF FACSIMILE TRANSMISSION**

I hereby certify that the foregoing was filed by facsimile with the United States Patent and Trademark Office, Examiner Julio Maldonado, Group Art Unit #2823 at fax number 571-273-8300 this 14<sup>th</sup> day of November, 2006.

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